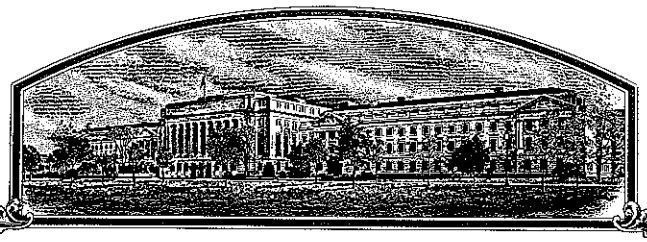
No. 9900171



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Minnesota Agricultural Experiment Station

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED, PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE , OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

WHEAT, COMMON

'HJ98'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this twenty-ninth day of February, in the year of our Lord two thousand.

Attest:

Commissioner
Plant Variety Protection Office

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions.* FORM APPROVED - OMB NO. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE DIVISION - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a).

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S) *(as it is to appear on the Certificate)*
Minnesota Agricultural Experiment Station

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER
SBE0050

3. VARIETY NAME
HJ98

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
University of Minnesota
190 Coffey Hall
1420 Eccles Avenue
St. Paul, MN 55108

5. TELEPHONE *(include area code)*
612-625-4211

6. FAX *(include area code)*
612-624-7724

FOR OFFICIAL USE ONLY

PVPO NUMBER 9900171

FILING DATE: 2/8/99

FEES RECEIVED
FILING AND EXAMINATION FEE: $ 2450.00
DATE: 2/8/99
CERTIFICATION FEE: $ 300
DATE: 1-19-00

7. GENUS AND SPECIES NAME
Triticum aestivum L.

8. FAMILY NAME *(Botanical)*
Graminecia

9. CROP KIND NAME *(Common name)*
Hard red spring wheat

10. IF THE APPLICANT NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)* *(Common name)*
Minnesota Agricultural Experiment Station

11. IF INCORPORATED, GIVE STATE OF INCORPORATION

12. DATE OF INCORPORATION

13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS
Robert H. Busch
USDA, ARS, MWA, PSRU, University of Minnesota
411 Borlaug Hall, 1991 Upper Buford Circle
St. Paul, MN 55108

14. TELEPHONE *(include area code)*
612-625-1975

15. FAX *(include area code)*
651-649-5058

16. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED *(Follow instructions on reverse)*

a. ☒ Exhibit A. Origin and Breeding History of the Variety
b. ☒ Exhibit B. Statement of Distinctness
c. ☒ Exhibit C. Objective Description of the Variety
d. ☒ Exhibit D. Additional Description of the Variety
e. ☒ Exhibit E. Statement of the Basis of the Applicant's Ownership
f. ☒ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties verification that tissue culture will be deposited and maintained in a public repository)*
g. ☒ Filing and Examination Fee ($2,450), made payable to "Treasurer of the United States" *(Mail to PVPO)*

17. DOES THE APPLICANT SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY, AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)?*
☒ YES *(If "yes," answer items 18 and 19 below)* ☐ NO *(If "no," go to item 20)*

18. DOES THE APPLICANT SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☒ YES ☐ NO

19. IF "YES" TO ITEM 18, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED?
☒ FOUNDATION ☒ REGISTERED ☒ CERTIFIED

20. HAS THE VARIETY OR A HYBRID PRODUCED FROM THE VARIETY BEEN RELEASED, USED, OFFERED FOR SALE, OR MARKETED IN THE U.S. OR OTHER COUNTRIES?
☒ YES *(If "yes," give names of countries and dates)* ☐ NO
Released as a cultivar for commercial use in US, 15 Feb 1998

21. The applicant(s) declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned applicant(s) is(are) the owner(s) of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 41, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Applicant(s) is(are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT *(Owner(s))*		SIGNATURE OF APPLICANT *(Owner(s))*	
NAME *(Please print or type)* Marilyn DeLong		NAME *(Please print or type)*	
CAPACITY OR TITLE Deputy Director, Ag Experiment Sta	DATE 2/3/99	CAPACITY OR TITLE	DATE

16a. Origin and Breeding History of the Variety

Pedigree: W8814/Norak

Where W8814 is a semidwarf line reselected from the variety 'Lark' by the Pioneer Wheat Breeding Program. Lark is a hard red spring wheat released by World Seed Inc. in 1974. Its pedigree is: Pitic 62 /4/ Kenya 58 / Newthatch /2/ Thatcher /3/Frontana / Thatcher /5/ Sonora 64. Northrop King Company, PVP Registration Number 8500105, released the other parent, 'Norak', in 1984. It is a semidwarf hard red spring wheat with the pedigree 'Era'/2/'Tobari 66'/'Ciano 67'/'Protor'.

The cross of W88 14/Norak was made under the direction of Dr. Ian Edwards and Herb Schmidt, Pioneer Hybrid International spring wheat breeding program. The Pioneer program was closed in 1989 and seed of their program was distributed to North Dakota, South Dakota, and Minnesota. SBE0050 was selected from that germplasm. The cross number associated with this line by Pioneer was retained throughout its testing at the University of Minnesota.

Disease testing for scab, stem rust and leaf rust was initiated in St. Paul in 1990 in inoculated nurseries and continued each generation. Yield testing was initiated in 1992 under the direction of Dr. R. Busch, USDA-ARS, University of Minnesota. SBE0050 was tested in advanced state yield trials from 1993 and in each following generation (Table 1, 2, 3). Wide area yield testing was conducted in the Uniform Regional Hard Red Spring Wheat Nursery in a total of 44 environments from 1995 and 1997. The Minnesota variety trial data are over 18 total environments.

About 500 heads were selected in 1994 and grown at St. Paul in the summer of 1995. After visual selection, 463 rows were selected and harvested as a purified bulk. A portion of this bulked seed was sent to the winter increase nursery in 1995-1996 to obtain breeders seed. The nursery was destroyed due to the quarantine of all wheat in Arizona because of possible Karnal bunt infection. Remnant bulked seed from the head rows grown at St. Paul in 1995 was seeded to produce breeders seed at St. Paul, MN, in 1996. HJ98 has remained phenotypically uniform and stable from 1994 through 1997 with less than 0.05% tall plants and 0.01% awnless plants observed. The tall plants phenotypically resemble HJ98 and are likely mutants to tall from semidwarf (variants). We do not know the origin of the awnless plants but they probably occurred during seed increase and are likely off types. Major increase occurred in 1997, with release of about 2200 bu. through Minnesota Crop Improvement Association in 1998.

16 b. Novelty Statement

Morphologically, HJ98 most closely resembles Verde, compared to other modern hard red spring wheat cultivars grown in the upper Midwestern USA.

Dr. Khan, Department of Cereal Science, North Dakota State University, Fargo, ND, 58105, at the request of Dr. R. Busch, was asked to obtain clear and useful gels for cultivar identification. The procedure used is published (Khalil Kahn, Richard Frohberg, Truman Olson, and Linda Huckle. 1989. Inheritance of Gluten Protein Components of High-Protein Hard Red Spring Wheat Lines Derived from *Triticum Turgidum* var. *dicoccoides.* Cereal Chem. 66 (5): 397-401) Dr. Khan used PAGE gel electrophoresis to determine the gliadin fraction of the gluten protein. It is the end product of the cultivars genetic constitution that produces the gliadin fraction. These gliadin bands are called genetic markers and are commonly used to discriminate among cultivars. They are not affected by environment, like many morphological traits, which are phenotypic measures, and represent consistently repeatable genotypic differences.

Dr. Busch requested gliadin fractionation to provide genetic differentiation among the following varieties for Plant Variety Protection: Norm, Marshall, Grandin, Verde, Pioneer 2375, Kulm, Trenton, Sharp, Russ, Oxen, Forge, Lars, Hamer, Nora, Hager, Sharpshooter, Keane, HJ98, Mercury and Ivan. HJ98 may be distinguished morphologically since it possesses a twisted flag leaf prior to heading at the boot stage, similar to Verde. Most of the other cultivars do not have twisted flag leaf prior to heading.

HJ98 does not possess band 10, which differentiates it from all other cultivars except Norm, Nora, and Ivan (Fig. 1). Only HJ98 and Ivan possess band 15, which then makes HJ98 unique from Norm and Nora but not Ivan (Fig. 1). Ivan posses band 4 which HJ98 does not possess differentiating HJ98 from all cultivars. Thus the gliadin-banding pattern of HJ98 easily differentiates this cultivar from the other recently released cultivars.

16c. Objective Description of the Variety

HJ98 is a hard red spring wheat, *Triticum aestivum* L. Agronornic data collected from 18 location-years from Minnesota Variety Trials on HJ98 and selected, presently or recently grown cultivars in the Upper-Midwest from 1996 through 1998 are presented in Table 1, 2, and 3. A combined analysis of variance of each environment and over all environment was conducted for traits with replicated data.. A FLSD 0.05 was computed using the cultivar x environment interaction from the combined analysis of variance except for the disease rating. This test assumes that the environments are random, and provides a conservative test for differences among the varieties. Pioneer 2375, Verde, Russ, Sharp, Oxen, Lars and Grandin were being grown by producers at the time of these tests. Kulm, Trenton, and Keane are relatively recent releases from North Dakota and are suggested to be grown in Western North Dakota since they are scab *(Fusarium* head blight) susceptible. Pioneer 2375 is being grown on approximately 40% of the Minnesota acreage, primarily because it has some resistance to scab. At least 5 of the 18 environments in Tables 1, 2, and 3 had scab epidemics. Scab was not present to any great extent in 1996 and 1998. HJ98 is intermediate for heading date since it differs only from Forge, Kulm, Sharp, Sharpshooter, Oxen, as earlier and Verde, Hager, Ivan and Marshall as later (Table 1). HJ98 is semidwarf in height differing from most of the normal height cultivars such as Kulm, Sharp, Sharpshooter, Russ Trenton and Keene. It is a taller semidwarf than Marshall, Ivan, Lars, with somewhat less resistance to lodging than average, and is slightly lower than average in test weight (Table 1).

HJ98 has been resistant to all tested races of stem rust (caused by *Puccinia graminis* Pers:Pers) both in the field and in the greenhouse in seedling growth stage (Table 2). HJ98 has also been resistant to moderately resistant to all naturally occurring leaf rust (caused by *P. reconditia* Rob. ex Desm.) races in adult field test in Minnesota.. HJ98 is moderately susceptible to foliar disease but shows resistance to scab spread in the head in greenhouse evaluations. No cultivar rates resistance and HJ98 will probably rate closer to moderately resistant than susceptible to scab. Tolerance to maintain plump kernels under scab epidemics is only average for HJ98 (Table 2).

HJ98 is very high yielding in both northern and southern Minnesota (Table 3). Its best performance is in northern Minnesota and it consistently has been one of the highest yielding cultivars in the northern Minnesota locations.

HJ98 has long, narrow, white glumes with an oblique shoulder and an acuminate beak. The spike is awned, mid-dense, and tapering. The kernel is red in color, ovate, mid-size, with rounded cheeks and a narrow, mid-deep crease. The brush has no collar and is medium in length. HJ98 displays at noticeable twisted flag leaf prior to heading in the boot stage of growth.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE DIVISION
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(*Wheat*)

OBJECTIVE DESCRIPTION OF VARIETY
WHEAT (*Triticum* spp.)

NAME OF APPLICANT(S)

Minnesota Agricultural Experiment Station

ADDRESS (*Street and No. or R.F.D. No., City, State, and Zip Code*)

University of Minnesota
220 Coffey Hall
1420 Eccles Avenue
St. Paul, MN 55108

FOR OFFICIAL USE ONLY

PVPO NUMBER 9900171

VARIETY NAME

HJ98

TEMPORARY OR EXPERIMENTAL DESIGNATION

SBE0050

PLEASE READ ALL INSTRUCTIONS CAREFULLY: Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (e.g. [ ][ ][ ] or [ ][ ]) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 100 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or any recognized color standard may be used to determine plant colors; designate system used: _____.

Please answer all questions for your variety; lack of response may delay progress of your application.

1. **KIND:**

[1] 1=Common 2=Durum 3=Club 4=Other (SPECIFY) _____

2. **VERNALIZATION:**

[1] 1=Spring 2=Winter 3=Other (SPECIFY) _____

3. **COLEOPTILE ANTHOCYANIN:**

[1] 1=Absent 2=Present

4. **JUVENILE PLANT GROWTH:**

[3] 1=Prostrate 2=Semi-erect 3=Erect

5. **PLANT COLOR (boot stage):**

[3] 1 = Yellow-Green 2 = Green 3 = Blue-Green

6. **FLAG LEAF (boot stage):**

[2] 1 = Erect 2 = Recurved [2] 1 = Not Twisted 2 = Twisted

7. **EAR EMERGENCE:**

[0][2] Number of Days Earlier Than Chris *

[0][0] Number of Days Later Than Pioneer 2375 *

8. **ANTHER COLOR:**

[1] 1 = YELLOW 2 = PURPLE

9. **PLANT HEIGHT (from soil to top of head, excluding awns):**

[ ][ ] cm Taller Than _____ *

[1][6] cm Shorter Than Chris *

10. STEM:

A. ANTHOCYANIN

[1] 1= Absent 2=Present

B. WAXY BLOOM

[2] 1=Absent 2=Present

C. HAIRINESS (last internode of rachis)

[1] 1=Absent 2=Present

D. INTERNODE (SPECIFY NUMBER) 6

[1] 1=Hollow 2=Semi-solid 3=Solid

E. PEDUNCLE

[2] 1=Absent 2=Present

[20] cm Length

11. HEAD (at Maturity):

A. DENSITY

[2] 1=Lax 2=Middense 3= Dense

B. SHAPE

[1] 1 = Tapering 2= Strap 3 = Clavate 4 = Other (SPECIFY) _____

C. CURVATURE

[1] 1 = Erect 2 = Inclined 3 = Recurved

D. AWNEDNESS

[4] 1 = Awnless 2 = Apically Awnletted 3 = Awnletted 4 = Awned

12. GLUMES (at Maturity):

A. COLOR

[1] 1 = White 2 = Tan 3 = Other (SPECIFY) _____

B. SHOULDER

[2] 1 = Wanting 2 = Oblique 3 = Rounded 4 = Square 5 = Elevated 6 = Apiculate

C. BEAK

[3] 1 = Obtuse 2 = Acute 3 =Acuminate

D. LENGTH

[3] 1 = Short (ca. 7mm) 2 = Medium (ca. 8mm) 3 = Long (ca. 9mm)

E. WIDTH

[1] 1 = Narrow (ca. 3mm) 2 = Medium (ca. 3.5mm) 3 = Wide (ca. 4mm)

13. SEED:

A. SHAPE

[1] 1 = Ovate 2 = Oval 3 = Elliptical

B. CHEEK

[1] 1=Rounded 2=Angular

C. BRUSH

[2] 1=Short 2=Medium 3=Long

[1] 1 = Not Collared 2 = Collared

D. CREASE.

[2] 1 = Width 60% or less of Kernel
2 = Width 80% or less of Kernel
3 = Width Nearly as Wide as Kernel

[2] 1 = Depth 20% or less of Kernel
2 = Depth 35% or less of Kernel
3 = Depth 50% or less of Kernel

13. **SEED:** (continued)

E. COLOR

[3] 1 = White 2 = Amber 3 = Red 4 = Other (SPECIFY) _____

F. TEXTURE

[1] 1=Hard 2=Soft

G. PHENOL REACTION *(see instructions)*:

[ ] 1 = Ivory 2 = Fawn 3 = Light Brown 4 = Dark Brown 5 = Black

14. **DISEASE:** (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED

Stem Rust *(Puccinia graminis* f. sp. *tritici)*
[2] TPMK, HJCS, RTQQ, QSHS,RKQS

Leaf Rust *(Puccinia recondita* f. sp. *tritici)*
[2] to most prevalent isolates

Stripe Rust *(Puccinia striiformis)*
[0]

Loose Smut *(Ustilago tritici)*
[0]

Tan Spot *(Pyrenophora tritici-repentis)*
[3]

Flag Smut *(Urocystis agropyri)*
[0]

Halo Spot *(Selenophoma donacis)*
[0]

Common Bunt *(Tilletia tritici* or *T. laevis)*
[0]

Septoria nodorum (Glume Blotch)
[0]

Dwarf Bunt *(Tilletia controversa)*
[0]

Septoria avenae (Speckled Leaf Disease)
[0]

Karnal Bunt *(Tilletia indica)*
[1]

Septoria tritici (Speckled Leaf Blotch)
[3]

Powdery Mildew *(Erysiphe graminis* f. sp. *tritici)*
[0]

Scab (*Fusarium* spp.)
[3] soread tolerant

"Snow Molds"
[0]

"Black Point" (Kernel Smudge)
[0]

Common Root Rot *(Fusarium, Cochliobolus* and *Bipolaris* spp.)
[0]

Barley Yellow Dwarf Virus (BYDV)
[0]

Rhizoctonia Root Rot *(Rhizoctonia solani)*
[0]

Soilborne Mosaic Virus (SBMV)
[ ]

Black Chaff *(Xanthomonas campestris* pv. *translucens)*
[3]

Wheat Yellow (Spindle Streak) Mosaic Virus
[ ]

Bacterial Leaf Blight *(Pseudomonas syringae* pv. *syringae)*
[0]

Wheat Streak Mosaic Virus (WSMV)
[ ]

Other (SPECIFY) _____
[ ]

Other (SPECIFY) _____
[ ]

Other (SPECIFY) _____
[ ]

Other (SPECIFY) _____
[ ]

Other (SPECIFY) _____
[ ]

Other (SPECIFY) _____
[ ]

15. INSECT: (0=Not Tested; 1=Susceptible; 2=Resistant; 3=Intermediate; 4=Tolerant)

PLEASE SPECIFY BIOTYPE (where needed)

Hessian Fly *(Mayetiola destructor)* [0] _____

Other (SPECIFY) [ ] _____

Stem Sawfly *(Cephus* spp.) [0] _____

Other (SPECIFY) [ ] _____

Cereal Leaf Beetle *(Oulema melanopa)* [0] _____

Other (SPECIFY) [ ] _____

Russian Aphid *(Diuraphis noxia)* [0] _____

Other (SPECIFY) [ ] _____

Greenbug *(Schizaphis graminum)* [0] _____

Other (SPECIFY) [ ] _____

Aphids [0] _____

Other (SPECIFY) [ ] _____

16. ADDITIONAL INFORMATION ON ANY ITEM ABOVE, OR GENERAL COMMENTS:

16d. Exhibit D, Additional Description of the Variety

The USDA Spring Wheat Quality Laboratory in Fargo, ND 58105 evaluated HJ98 for quality from small plots. Only 1997 data are presented since several of the cultivars were not yet released in 1996 and data have not yet been processed from 1998 (Table 4). Quality testing was initiated in 1993 with protein and mixing tests, and continued including baking tests beginning in 1994. Obviously major differences for bread making quality are not apparent in this mean table from six locations. Precise error terms on the traits were not available since data were not replicated. HJ98 compared to the other cultivars is low to intermediate in wheat and flour protein, looks somewhat low for flour extraction on the small sample mill, but has very good mixing and baking traits.

Bread making quality tests by industry in large plot trials conducted by the Spring Wheat Quality Council in 1995 and 1997 (Tables 5 and 6) Bread-making quality of HJ98 was compared to the industry check cultivar, Grandin, at two locations in 1995 and at three locations in 1997.

In the 1995 Spring Wheat Quality Council Trials, HJ98 was judged comparable overall to Grandin, the high quality check cultivar over categories 1-20 overall comparison (Figure 2) when averaged over the two locations (Table 5). In the 1997 tests grown at three locations, HJ98 was judged to be somewhat lower in overall rating, probably because it is lower in protein and bake absorption, but overall did not differ significantly from Grandin (Table 6). Cooperators commented that they liked the baking properties better than Grandin. Flour extraction, rather low on the small plot mill, was acceptable on the large sample commercial mill. Its mixing and baking properties were described by industry tests as desirable.

Table 1. Growth characteristics of HJ98 and hard red spring wheat cultivars, 1996-1998.

Note Key:
[1] Heading date.
[2] Height expressed in inches.
[3] Lodging score. 1=erect, 9=flat.
[4] Test weight expressed as pounds per bushel.
[5] Protein expressed as a percentage, calculated at 12% moisture.
[6] 1997-1998 data.
[7] 1998 data only.

Cultivar	Heading [1]	Height [2]	Lodging [3]	Test Weight [4]	Wheat Protein [5]
Forge	6-24	32	2.7	60.2	15.1
Kulm	6-25	35	3.0	60.1	15.7
Sharp	6-25	34	3.4	60.8	15.1
Sharpshooter [6]	6-26	35	3.5	60.8	15.1
Oxen	6-26	31	3.1	58.9	15.2
Russ	6-27	34	3.3	58.8	14.9
Grandin	6-27	33	2.6	59.4	15.5
Hamer	6-27	31	2.2	59.4	14.9
Nora [6]	6-27	28	3.3	57.9	15.5
2375	6-28	33	4.3	59.9	14.9
Trenton	6-28	37	3.7	59.5	15.6
HJ98	6-28	32	3.9	58.2	14.5
Mercury [6]	6-28	28	2.3	58.4	14.4
Keene [6]	6-28	38	3.0	58.9	15.4
Lars	6-29	28	2.3	58.0	14.1
Norm	6-29	32	2.3	57.1	14.0
Verde	6-30	32	2.7	59.0	14.3
Hager [6]	6-30	32	2.7	58.0	15.1
Ivan [7]	6-30	30	2.2	58.1	14.0
Marshall	7-1	30	1.9	57.5	14.3
Lsd 0.05	1	1	1	0.8	0.3

Table 2. Disease susceptibility and tolerances of HJ98 and ard red spring wheat cultivars 1996-1998

Note Key :

[1] R=resistant, MR=moderately resistant, MS=moderately susceptible, S=susceptible.

[2] Rated based on NDSU data from 1996-1998.

[3] Tolerance to maintain plump kernels under scab epidemics:
1 = very well, 2 = well, 3 = moderate, 4 = fair, 5 = poor.

[4] 1997-1998 data.

[5] 1998 data only.

Cultivar	Leaf Rust [1]	Stem Rust [1]	Foliar Disease [1] [2]	Scab Severity [1]	Scab Tolerance [3]
Forge	MS	R	MS	MS-S	2.5
Kulm	MR	R	S	S-MS	2.5
Sharp	MR	R	MS	MS-MR	2.5
Sharpshooter [4]	MR	R	MS	MS-MR	2.5
Oxen	MS	MR	MS	MS-S	3.0
Russ	MR	MR	S	MS	3.0
Grandin	MS	R	S	MS-S	3.0
Hamer	MR	R	MR	MS-S	3.5
Nora [4]	MR	R	MR	S	4.0
2375	MS	R	S	MS	2.5
Trenton	MS	MR	MS	MS-S	3.0
HJ98	MR	R	MS	MS	3.5
Mercury [4]	MR	R	MS	S	4.5
Keene [4]	MR	R	MR	MS	3.0
Lars	MR	R	MR	S	4.5
Norm	R	R	MR	S	5.0
Verde	MR	R	MR	MS-S	3.0
Hager [4]	MR	R	MS	S-MS	3.5
Ivan [5]	MR	R	MS	S-MS	3.5
Marshall	MS	R	MS	MS-S	3.5

Table 3. Yields, in bushels per acre, of HJ98 and hard red spring wheat in MN, 1996-1998

Note Key :
[1] 1998 data only.
[2] 1997-1998 data.
[ ] Number of location-years

Cultivar	South Avg [11]	North Avg. [7]	State Avg. [18]
Forge	52	50	51
Kulm	54	47	50
Sharp	49	49	49
Sharpshooter [2]	48	48	48
Oxen	56	53	55
Russ	53	46	50
Grandin	49	46	47
Hamer	55	52	53
Nora [2]	46	45	45
2375	51	52	51
Trenton	50	45	48
HJ98	55	56	55
Mercury [2]	55	53	54
Keene [2]	51	43	48
Lars	54	53	53
Norm [3]	54	46	50
Verde	56	54	55
Hager [2]	48	50	48
Ivan [1]	51	54	53
Marshall	43	47	45
Lsd 0.05	5.4	5.4	3.9

Table 4. Small plot milling and baking traits of HJ98 and hard red spring wheat cultivars from 6 MN locations, 1997

Note Key:

Data from USDA Hard Red Spring Wheat Quality Laboratory, Fargo, ND--Dr. Hareland

[1] Mean from single kernel hardness machine

[2] Protein % at 13% moisture

[3] % flour extracted Quadramat Jr.

[4] % water absorbed by given quantity of flour

[5] Graphic evaluation of mixogram curve-1=very weak to 11=very strong

[6] Minutes to peak

[7] Volume of the baked loaf in cc

Cultivar	Hardness [1]	Wheat protein [2]	Flour extraction [3]	Flour protein [2]	Mixogram absorption [4]	Mixogram pattern [5]	Mixing time [6]	Loaf volume [7]
Forge	69	15.1	59	14	59	3	3.5	202
Kulm	70	15.6	58	14.8	64	3	2.5	214
Sharp	74	15	57	14.1	60	2	3	209
Sharpshooter	62	14.5	59	13.6	61	2.5	2.4	202
Oxen	79	14.4	61	13.4	61	3.5	3.1	203
Russ	73	14.2	57	13.4	60	3	3.7	206
Grandin	68	15.1	57	14.1	60	3	3	210
Hamer	65	14.3	60	13.3	62	3	2.8	210
Nora	71	15.5	54	14.6	60	2.5	3.4	210
2375	80	14.8	55	13.3	58	2	3.3	201
Trenton	69	15	58	14.2	62	3	3.5	212
HJ98	72	14	54	13.1	58	3	3.6	206
Mercury	67	13.8	62	12.6	59	3	2.8	213
Keene	78	15.1	56	14	60	2.5	2.6	206
Lars	69	13.5	60	12.6	59	3.5	3.6	198
Norm	68	13.6	57	12.7	61	3	3.2	201
Verde	73	13.7	64	12.3	60	2	3.25	192
Hager	66	14.7	56	13.7	61	3.5	3.5	221
Ivan	No	data	available					
Marshall	75	13.4	62	12.8	55	2	3	189

9900171

Table 5. **1995 Hard Spring Wheat Technical Committee**

Variety: SBE0500

Sample Code:	B-CK	B-4	K-CK	K-4	Average Grandin	Average SBE0500
Wht Protein(14%mb):	14.6	14.1	15.7	14.2	15.1	14.2
Wheat Ash(14%mb):	1.75	1.85	1.73	1.69	1.74	1.77
Test Weight(lb/bu):	59.8	58.4	59.2	57.7	59.5	58.1
1000-KWT(grams):	30.8	25.8	33.2	29.7	32.0	27.8
Large Kernels(%):	45	4	64	43	55	24
Small Kernels(%):	3	8	2	2	3	5
NIR Hardness:	78	69	86	79	82	74
Kernel Vit:	77.3	68.1	63.1	56.7	70.2	62.4
SKWCS HI:	73.9	73.1	70.1	64.2	72.0	68.7
Wht FN:	400	415	333	195	367	305
Fl Protein(14%mb):	13.2	13.0	14.5	13.5	13.8	13.2
Fl Ash(14%mb):	0.44	0.49	0.43	0.54	0.44	0.52
Fl Ext(%):	71.5	69.2	74.3	72.1	72.9	70.7
# .46 Ash Fl/cwt Wht:	73.1	69.9	74.3	72.7	73.7	71.3
Mill Value(S):	1.79	1.60	1.93	1.79	1.86	1.70
Farino Abs(14%mb):	61.0	57.7	61.9	60.2	61.5	59.0
Farino Arrival Time(min):	2.2	2.3	3.0	3.7	2.6	3.0
Farino Peak Time(min):	4.0	5.9	5.4	6.2	5.2	6.1
Farino Stability(min):	10.3	18.0	8.9	7.6	9.6	12.8
Farino MTI(BU):	24	14	25	33	24.5	23.5
Bake Abs(14%mb):	62.0	60.9	63.2	61.6	62.6	61.3
Bake Abs Rating:	3.3	2.8	3.6	2.9	3.4	2.9
Bake Mix Time Actual:	14.1	16.0	9.3	9.1	11.7	12.5
Bake Mix Time Rating:	4.4	5.0	3.1	2.9	3.7	4.0
Mix Tolerance Rating:	4.3	5.2	2.8	2.3	3.5	3.7
Out of Mixer Rating:	4.4	3.0	3.6	3.9	4.0	3.4
Out of Mixer Describe:	2.1	1.7	1.9	2.0	2.0	1.8
At Make Up Rating:	3.8	2.7	3.5	3.8	3.6	3.3
At Make Up Describe:	2.3	1.4	1.8	2.2	2.0	1.8
Loaf Volume Rating:	3.3	4.0	3.5	4.1	3.4	4.0
Crumb Color:	3.8	5.0	3.3	4.7	3.6	4.8
Crumb Grain:	3.8	4.3	3.2	4.5	3.5	4.4
Crumb Texture:	4.3	4.5	3.6	4.6	4.0	4.6
Overall Rating:	3.8	3.7	3.4	3.6	3.6	3.6

Rating Scores : 0 3 6

Bake Absorption : Low ---------- High

Bake Mix Time : Short ---------- Long

Mixing Tolerance : Weak ---------- Strong

Out Of Mixer : Weak or Bucky ---------- Pliable

At Make Up : Weak or Bucky ---------- Pliable

Loaf Volume : Low ---------- High

Crumb Color : Yellow Grey Dull Creamy Bright White

Crumb Grain : Irregular,open,thick Open, thick Close,elongated,fine

Crumb Texture : Harsh Coarse Silky

Overall Rating : Poor ---------- Excellent

Out of Mixer Describe:
1. Sticky-Weak or Tough-Bucky
2. Medium
3. Pliable

At Make Up Describe:
1. Sticky-Weak or Tough-Bucky
2. Medium
3. Pliable

Table 6. 1997 Hard Red Spring Wheat Technical Committee Evaluation

Variety:SBE0050 Grandin is Check

Traits	Mean 3 locations	
	Grandin	HJ98
Wheat protein (%)	15.6	14.2
Test weight (lb/bu)	59.8	60.2
Hardness (NIR)	70	69
Flour protein (%)	13.9	13
Flour extration (%)	72	72
#0.46 Ash fl/Cwt wht	0.42	0.44
Mill value ($)	8.64	8.54
Farino abs (14^mb)	61.9	59.4
Farino peak time (min)	7.4	9.4
Farino stability (min)	18.8	14.6
Farino MT (BU)	20.8	29.7
Bake water absorb (%)	62	60
Ratings by cooperators		
Mix tolerance	4.2	3.8
Mix time	4	3.7
Out of mixer	3.8	3.9
At make up	3.7	3.8
Loaf volume	4.6	4.1
Crimb color	4.3	4.4
Crumb grain	3.6	3.8
Crumb texture	3.8	4.1
Overall Rating	4.2	3.8
LSD 0.05 = 0.8		

REPRODUCE LOCALLY. *Include form number and edition date on all reproductions.* FORM APPROVED - OMB NO. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S)

Minnesota Agricultural Experiment Station

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER

SBE00050

3. VARIETY NAME

HJ98

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*

University of Minnesota
190 Coffey Hall
1420 Eccles Avenue
St. Paul, MN 55108

5. TELEPHONE *(include area code)*

612-625-4211

6. FAX *(include area code)*

612-624-7724

7. PVPO NUMBER

9900171

8. Does the applicant own all rights to the variety? *Mark an "X" in appropriate block.* If no, please explain. [X] YES [ ] NO

9. Is the applicant (individual or company) a U.S. national or U.S. based company? [X] YES [ ] NO
If no, give name of country

10. Is the applicant the original owner? [X] YES [ ] NO *If no, please answer one of the following:*

a. If original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. national(s)?

[ ] YES [ ] NO If no, give name of country

b. If original rights to variety were owned by a company(ies), is(are) the original owner(s) a U.S. based company?

[ ] YES [ ] NO If no, give name of country

11. Additional explanation on ownership *(if needed, use reverse for extra space)*:

PLEASE NOTE:

Plant variety protection can be afforded only to owners (not licensees) who meet one of the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.

2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.

3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definition.

STD-470-E (07-97) *(Destroy previous editions).*
Electronic version designed using WordPerfect InForms by USDA-AMS-IMB.

16e. Exhibit E. Statement of the Basis of Applicant's Ownership

The Pioneer Spring Wheat Breeding Program was discontinued in 1989, and germplasm was distributed to Unniversity breeding programs in Minnesota, North Dakota, and South Dakota. SBE0050 was a selected line, but had not been in yield test so would not be considered an elite line. All testing, reselection and increasing were conducted by the joint USDA-ARS and Minnesota Agricultural Experiment Station spring wheat improvement program. The original cross and selection were conducted under direction of Dr. Ian Edwards, Pioneer, and testing and reselection were conducted under direction of Dr. Robert Busch, Research Geneticist, USDA-ARS and employees of the University of Minnesota, Minnesota Agricultural Experiment Station. Registration of HJ98 acknowledges Pioneer's research effort, but complete ownership of this cultivar is claimed by Minnesota Agricultural Experiment Station and by USDA-ARS.

9900171

United States Department of Agriculture
Agricultural Marketing Service
Science Division
Plant Variety Protection Office
NAL Building, Room 500
10301 Baltimore Blvd.
Beltsville, MD 20705-2351

PLANT VARIETY PROTECTION OFFICE

Gentlemen:

Subject: Application No. 9900171
Variety and Kind: HJ98 (Triticum aestivum L) hard red spring wheat

As provided in section 83(a) of the Plant Variety Protection Act, 7 U.S.C. 2321, we request that the Certificate on the above variety be issued with a notation on the Certificate that the right to exclude others from selling, offering for sale, reproducing, importing or exporting the variety covered by this Certificate, or using it in producing a hybrid or different variety is waived, except that this waiver shall not apply to breeders seed, foundation seed, labeling requirements, and blending limitations.

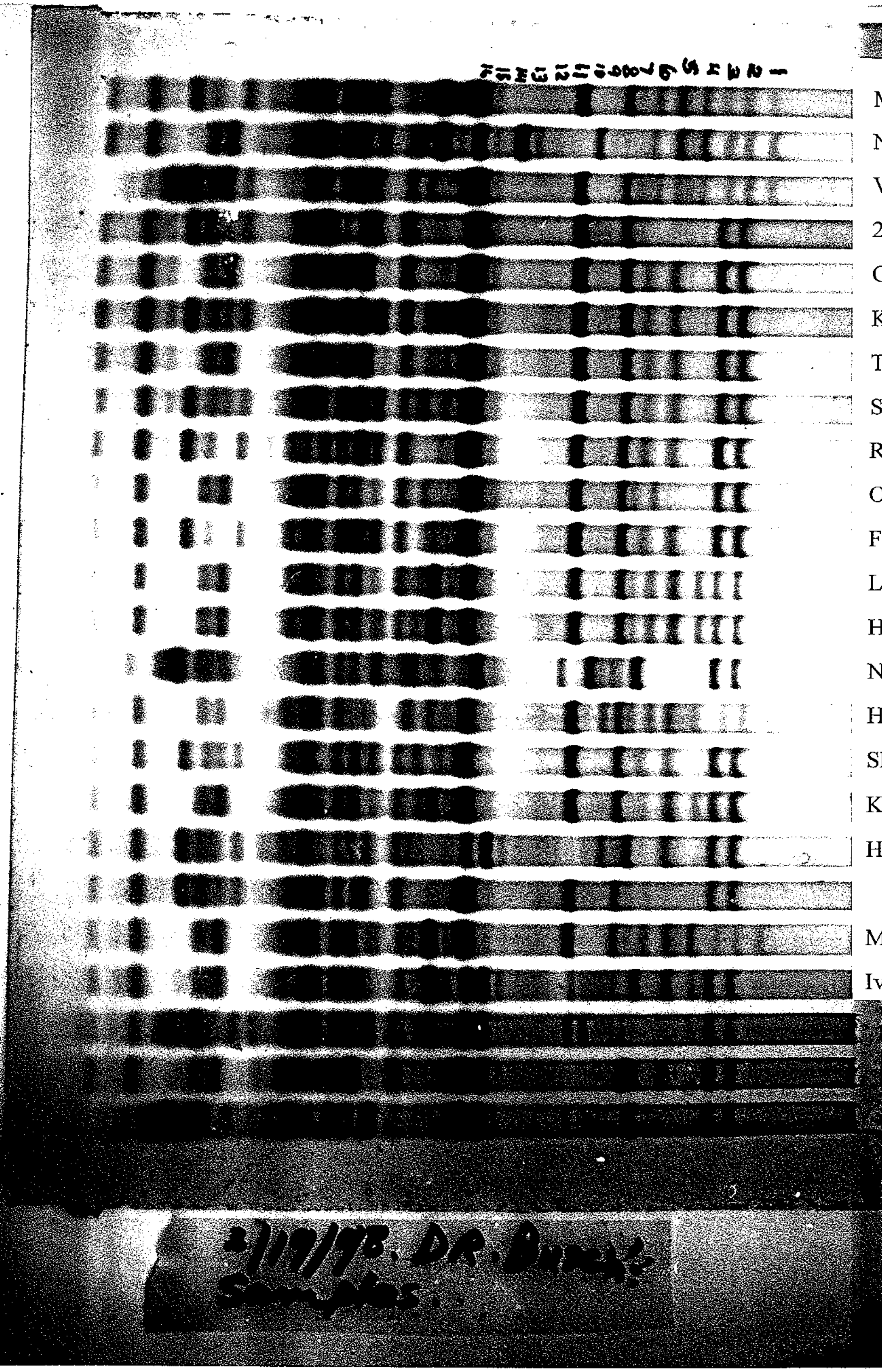
It has been agreed that the Certificate should be issued in the name(s) of:

Minnesota Agricultural Experiment Station

September 28,1999
(Date)

(Signature)

Gliadins



Marshall
Norm
Verde
2375
Grandin
Kulm
Trenton
Sharp
Russ
Oxen
Forge
Lars
Hamer
Nora
Hager
Sharpshooter
Keene
HJ98
Mercury
Ivan
Standards

Figure 1.